

Los Angeles City Fire Department

TRAINING BULLETIN

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TRAINING BULLETIN NO. 42 SINGLE-STATION SMOKE DETECTORS

INTRODUCTION

- Fire is the third leading cause of accident death in the United States.
- Fire threatens people more at home than anywhere else. Seven out of ten Americans killed by fire are killed at home.
- Six out of ten fatal home fires start between 9:00 p.m. and 6:00 a.m. Victims are usually dead from smoke and poisonous gases long before the flames of fire can reach them.
- Fortunately smoke detectors can be on duty night and day monitoring the air while people sleep.
- Current law in the Building and Fire Codes now require smoke detectors in new homes at time of construction and in existing homes at the time of sale. In new and existing duplexes, apartments, condominiums, and hotels, smoke detectors are required as of August 8, 1980.
- Existing apartment hotels and hotels over 75 feet in height require smoke detectors by August 1, 1981. If the building complies with the retroactive high-rise requirements of Title 19, smoke detector installation may be delayed until August 1, 1982.

GENERIC TYPES OF SMOKE DETECTORS

Smoke detectors are made in different shapes, but they all work by permitting room air to pass through an internal sensing chamber. When visible or invisible products of combustion (i.e., smoke or gases) enter the sensing chamber, an alarm is activated. The chamber detects products of combustion by one of two methods--photoelectric or ionization.

Photoelectric

In the photoelectric smoke detector, a light source projects a beam of light across a darkened chamber within the detector. A photocell is located in the chamber out of the normal light path. When smoke enters the chamber, the light striking the smoke is scattered in the same way that auto headlights are scattered by fog. When sufficient light is scattered onto the photocell, the alarm is sounded.

Ionization

Ionization detectors use a minute amount of radioactive material to ionize the air between two interior electrodes conducting a small electric current. Invisible particles that enter the ionized detector chamber reduce the flow of current, finally break the current flow, and then set off an alarm.

SOURCE OF POWER

All detectors, whether they are ionization or photoelectric, can be powered by either batteries or house current. Battery-powered units are by far more popular, are entirely self-contained, and can be installed anywhere. There is virtually no difference in the response efficiency between the two power sources. When detectors must be hard-wired to the house current, as required by Los Angeles Codes plug-in type units may not be considered as fulfilling the hard-wire requirement.

Smoke detectors shall be installed by August 8, 1980, in all existing multiple-dwelling occupancies and duplexes with the option of being battery-operated until August 1, 1983, at which time the detectors must be hard-wire connected to the electrical system of the building.

Battery-powered detectors are reliable only so long as the batteries are replaced on a timely schedule. National statistics from the U.S. Fire Administration indicate that most battery-type detectors become inoperative due to dead batteries or batteries removed and not replaced. It is unlikely that depleted batteries will promptly be replaced in all households, especially those dwelling units occupied by tenants rather than building owners. Concern for loss of electrical power is answered by the Department of Water and Power stating that the average residence is without power only three minutes per year. Therefore, our Ordinance maximizes the requirement for permanently wired detectors in all multiple-dwelling occupancies.

MOUNTING LOCATIONS

Most units may be mounted either on the ceiling or on the wall. A manufacturer's pamphlet is included with each approved detector, and this pamphlet tells how the unit may be mounted. Test of the two types of mounting show there is no difference in their effectiveness.

A detector shall be installed in each bedroom and in the hallway or area giving access to the bedroom, and in a multi-story dwelling on each level at the top of the stairway. The hallway detector could also fulfill the top of the stairway requirement. Detectors located outside the bedroom presupposes that the occupants sleep with their doors shut to provide a barrier to the smoke thus gaining additional seconds for escape. However, even if occupants (unsafely) sleep with their bedroom doors open, it is still necessary to provide the required smoke detectors to ensure adequate escape time.

INDIVIDUAL VS. INTERCONNECTED DETECTORS

In most smoke detector installations, whether battery or hard-wired, the detectors are not linked together and operate independently. If more than one detector is installed, and they are both hard-wired to the house current, the detectors may be linked together. Then when one detector senses smoke, it will set all detectors in the house into alarm. To awaken people, especially in their deepest level of sleep, interconnection of detectors is a desirable feature.

WHICH GENERIC TYPE OF DETECTOR WORKS BEST?

This Department, in coordination with the California Fire Chiefs' Association, completed a comprehensive fire detector test program in 1978. Results of these tests strongly point to photoelectric detectors being more reliable in warning against the hazards of visible smoke build-up from the slow smoldering fire so common to residential occupancies. Photoelectric detectors appear to be less prone to unwarranted nuisance alarms.

Radioactivity of smoke detectors is a frequently mentioned concern of the public. There is a small amount of radiation emitted only by the ionization detector. The amount of radiation emitted is insignificant. About 70 years exposure to a home smoke detector is equal to the exposure received from one chest X-ray. Normal background radiation increases with an increase in elevation above sea level. The added exposure from an ionization detector is equivalent to an individual moving to an area 16 feet higher in altitude.

Smoke is incomplete combustion, a cloud of fine carbon particles suspended by gases given off by a fire. For a given material, smoke that is generated under smoldering conditions is referred to as cold smoke and is of a larger particle size than smoke generated under active flaming conditions. Fast-burning fires (as from flaming paper, a butane torch, a cooking flame or a heater flame) give off gases and aerosols so small as to be invisible. Herein lies the problem associated with the ionization-type detector. The ionization detector is sensitive to these invisible products of combustion, as well as any changes in the chemical make-up of the atmosphere such as steam or natural cooking odors. The ionization detectors in hallways containing gas-type heaters or hallways in close proximity to kitchen areas are a direct result.

Photoelectric detectors are more sensitive to smoldering fires, ionization to flaming fires. A special subcommittee of the International Association of Fire Chiefs' states in the September, 1980 issue of the International Fire Chief Magazine the following:

"...because of the present state-of-the-art in detecting smoke, the Subcommittee on Smoke Detection can take no other course but to recommend the installation of photoelectric detectors."

Only smoke detectors approved by the California State Fire Marshal can be sold or installed in California. The Fire Marshal's Office requires laboratory testing of all detectors, but the tests have only a pass/fail criteria. All detectors meeting UL-217, test standard, are approved and should respond similarly. However, in real life applications, ionization and photoelectric detectors do respond differently.

NUISANCE ALARM PROBLEMS

The Fire Department has endeavored to reduce the number of nuisance alarms by insuring proper placement of smoke detectors (away from wall heaters and kitchens), and through public education. Detectors are approved to give an area of coverage equivalent to a 25' diameter. Therefore, in order to shy away from wall heaters, kitchens, or other heat-producing appliances, a detector could be moved 12.5' away from the bedroom door and still be protecting the area giving access to the bedroom. Sometimes, in aggravated cases, a change of detector to a photoelectric-type could also solve the problem. It must be emphasized that this detector placement in the hall is exactly as recommended in the National Fire Protection Association Standard Number 74 for the minimum level of protection in residential occupancies.

MAINTENANCE

Smoke detector maintenance is easy but important. To keep them functioning, dust must be vacuumed or blown from the unit occasionally; batteries and burned-out incandescent light bulbs must be replaced. To test the operation of a detector, push the test button. The best method of checking older units, not utilizing test buttons, is to blow smoke into the chamber or use of smoke detector test aerosol.

It is most important to remember that "detection" is only the first step leading to "protection." An escape plan must be discussed and regularly practiced by the family who wants to be safe from fire.

NOTE: The Los Angeles City Fire Department does not recommend a smoke detector manufacturer or photoelectric detectors over ionization detectors. The information contained in this bulletin regarding superior performance characteristics of photoelectric detectors is informational only, and only reflects the current state-of-the-art.